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the entire development becomes affected, that is, functional adaptations are transmissible.

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Effects of the Rays of Radium on Plants. By CHARLES STUART GAGER. Memoirs of the New York Botanical Garden, Vol. IV., 1908. Imp. 8vo, viii + 278 pages, 73 figures and 14 plates. Price \$2.00.

As known to several botanists, the author was engaged for some time in studying the effects of radioactivity on various plant processes. The present volume represents the sum and substance of approximately four years of labor and is presented as a pioneer investigation; comprehensive in scope and as offering initial suggestions for several important problems.

During the research period "standard preparations of the purest radium bromid yet obtained" were placed at the disposal of Dr. Gager by Mr. Hugo Lieber, of New York City. As a result of the cooperation of liberality and investigation we may now feel quite certain that the rays of radium constitute a stimulus to the metabolic processes in plants. In conformity with other stimuli, that of radioactivity exhibits a minimum, optimum and maximum. Metabolic processes in general, whether constructive or destructive, are accelerated by intensities of stimulation between the minimum and optimum, while greater intensities beyond the optimum retard until death follows at the maximum.

Looking more particularly at the individual topics treated, we find an initial chapter of fourteen pages which constitutes a digest of about one hundred and fifty citations. In clear and rather popular style the essential facts of the nature of radioactivity are presented.

The universal presence of radioactivity in soil, water, rain, snow, etc., is elaborately discussed and the obvious deduction drawn that living matter can hardly escape its influence. Such being the case, any sudden change in the intensity of the emanations would be expected to constitute a stimulus to the exposed organisms.

Quite appropriately some attention is given to the undemonstrated conclusions of various authors regarding radioactivity as a property of wood, flowers and other plant organs. The unsuccessful efforts to artificially create life through the influence of radium are explained. An historical review of previous work done on both plants and animals occupies several pages.

The power of radium to affect the germination of seeds and the subsequent growth of the seedlings is clearly shown by the author's own work. A given plant can be educated, so to speak, to endure an intensity of stimulus which on first exposure retarded growth. This shows that since radioactivity is so universal in nature that plants are probably naturally attuned to at least a low intensity which may be gradually increased without disturbing the normal processes in the plant. Freshly fallen rain may have sufficient radioactivity to retard growth of plant organs. The same may be true of tap-water previously exposed to the emanations of radium.

Alcoholic fermentation, and respiration, both aerobic and anaerobic, were found to respond to stimulus. On the other hand, tropistic responses were not with certainty demonstrated.

The profound influence of the rays of radium is manifest if we look at the abnormalities arising in the cells and tissues of plants exposed. Thus in the hypocotyls of beans, lupins, etc., retardation of growth was accompanied by a lack of coordination in histogenesis, stoppage of cell-division, acceleration of tissue-differentiation, decrease in size of the cells. In a given case any one or all of those effects may be found. Mitosis in any of its phases is likely to be profoundly modified with marked distortion of the mitotic figures and disturbance of the normal processes of nuclear division.

The attempts to induce mutation by radioactivity were not continued to success, though some intimations were obtained that it may be possible to do so.

The paper closes with an extended theoretical discussion of about seventeen pages.

From the facts included in this descriptive review it is evident that this work has a com-

prehensive value both to those who may be interested from the popular standpoint and to those who intend to work themselves. The bibliography includes about five hundred and sixty-five citations.

For valuable counsel during the earlier progress of the work the author makes acknowledgment to Professor Wm. J. Gies.

RAYMOND H. POND

BOTANICAL NOTES

THE EAR-ROTS OF INDIAN CORN

Two recent bulletins deal with this serious trouble to our most important crop. The first is "The Life-History and Parasitism of *Diplodia zeae* (Schw.) Lev.," by F. D. Heald, E. M. Wilcox and Venus W. Pool, in the Twenty-second Annual Report of the Nebraska Agricultural Experiment Station, January, 1909. This paper gives the results of the investigations which have been in progress for several years as to the cause of the extensive loss in Nebraska from ear-rots. The complete life-history of the fungus is worked out, the results of inoculations given and its distribution in the state shown. The illustrations are especially fine.

The second paper bears the title "Ear Rots of Corn," by Thomas J. Burrill and James T. Barret (Bull. No. 133, Ill. Agric. Exp. Sta., Feb., 1909). This a more extensive bulletin, largely upon the same subject as the earlier publication by the Nebraska Experiment Station, and is one which merits the careful reading of all plant pathologists, mycologists and others interested in the botanical or practical aspects of the subject. In Illinois the annual loss from ear rots is from two to four and a half per cent. of the entire crop, representing a money loss of from two to five and a half million dollars. This bulletin is the result of extensive investigations covering several years. Ninety per cent. of the rot was found to be due to *Diplodia zeae* (Schw.) Lev. The fungus was thoroughly studied in laboratory and field; inoculations were made to show the time and mode of infection; its round of life was carefully worked out, and means of prevention suggested.

Three species of *Fusarium* are largely responsible for the other rots. The characteristic rot of each species is described but work upon these forms is still incomplete.

MORE DARWIN LITERATURE

It may be well to record here several addresses that have seen the light in various places in printed form:

"Darwin as a Naturalist: Darwin's Work on Cross Pollination in Plants," is the title of Dr. William Trelease's address before the Botanical Society of America last winter, and published in *The American Naturalist* for March, 1909. This is first a general estimate of Darwin as a student of plants, followed by an analysis of his contributions to our knowledge of the mechanism and meaning of cross pollination, including a list of his publications (twenty-two titles) on pollination and fertilization.

"Darwin and Botany" is the title of a short address given by Dr. N. L. Britton at the American Museum of Natural History on February 12 last, and published in the *Popular Science Monthly* for April, 1909. In this the writer traces the evolution of Darwin's contributions to botany, and declares that "the value of the impulse given by Darwin to botanical investigation in all its branches is beyond estimation."

Professor J. M. Macfarlane's first address, "Darwin in Relation to his own and the Pre-Darwinian Period," before the faculty and students of Pennsylvania College, February 12, is a summary review of the period preceding Darwin's work, and the steps by which the different phases of the doctrine of evolution have been attained. His second address, "Lessons from the Life and Writings of Charles Darwin," before the members of the Philadelphia Girls' High School, February 15 and 23, brings out Darwin's persistence in his work, his self-denial, his sweet spirit, free from envy or jealousy and his faith in the ultimate dominance of truth. His third address, "The Legacy Left us by Darwin and his Collaborators," before the Linnean Society, the faculty and students of Franklin and Marshall College, February 27, dwells upon